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BECS IN MICROGRAVITY

Abstract

Recently a free expansion of a 10000 Rb-atom condensate was achieved for extremely long times (1s). The Bose-Einstein condensate is first prepared and trapped magnetically in the vicinity of an atom chip. The release of the atomic ensemble is performed when the experiment is dropped down in the ZARM tower facility in Bremen. Thus a free expansion is obtained during the free fall and could be used to observe quantum refection of the BEC on the chip surface. Several experiments of quantum reflection were done in the last years, but our model predicts high reflectivity due to the very slow incident velocities (less than 1 mm/s) of the cold atoms in the Quantus experiment. The dilute character of the cloud after 1s of expansion should also minimize the effect of mean-field interactions and lead to a good agreement with the quantum reflection theory. In addition, we interpret theoretically the expected interference fringes between reflected and incoming atoms to obtain a highly accurate measurement of the shift caused by the atom-surface interactions. Thus we could probe the attractive Casimir-Polder potential over an extended spatial range only reached thanks to the coherence of the source and the use of interferometric measurements. The QUANTUS project is a collaboration of the U Hamburg, U Ulm, HU Berlin, MPQ Munich, ZARM at U Bremen, and the LU Hanover. It is supported by the German Space Agency DLR with funds provided by the Federal Ministry of Economics and Technology (BMWi) under grant number DLR 50 WM 0346.